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CHARACTERISTICS OF HIGH STANDING
UNIVERSITY STUDENTS ON THE WECHSLER
BELLEVUE ADULT INTELLIGENCE SCALE

W. J. Lott

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SYNOPSIS

A study was done of the characteristics of a group of high standing university students as revealed by the scatter indices of the Wechsler Bellevue Intelligence Scale. It was hypothesized that a group of high standing, academically well adjusted, university students would show minimal vocabulary scatter on the Wechsler Bellevue.

An experimental, or high standing, group was specially selected and consisted of those students in second year university who were maintaining a 75% average or better for their high school leaving examinations and their final examinations for first and second year of university. They were compared to a control group, consisting of students who had been referred to the Student Advisory Services because they were failing academically.

Contrary to the hypothesis, by means of the critical ratio, the experimental group revealed considerably more vocabulary scatter than the control group. This was believed to be a result of the manner in which the subjects were selected, as there were almost three times as many Science pattern students as there were Arts pattern students in the experimental group. For that reason it is believed that the results are questionable and that the study should be repeated, ensuring that there is a more proportionate representation of Arts students to Science students.

A secondary aspect of the study was to compare the following subgroups of the experimental group: males to the females; 17 to 19 year old to the 20 to 23 year old; 80 to 85% average to the 75 to 79% average;

and the Arts students to the Science students. Each subgroup was found to be quite comparable to its counterpart. All but the Arts students showed considerable vocabulary scatter.

A third aspect of the study was to compare the experimental group with studies done by Estes (8), Merrill and Heathers (34), and Rakusin (44). All three of these studies indicated, by their methods of selecting subjects, that considerable vocabulary scatter was to be expected on testing university students with the Wechsler Bellevue Intelligence Scale.

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CHARACTERISTICS OF
HIGH STANDING UNIVERSITY STUDENTS ON
THE WECHSLER BELLEVUE ADULT INTELLIGENCE SCALE

A DISSERTATION
SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES
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W.J.L.

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Chapter I

INTRODUCTION

General Considerations

Ever since psychological tests containing different types of subtests have been used to appraise "general intelligence" the aspect of "scatter", or variation in subtest performance, has intrigued psychologists. Ideally, in the normal, well adjusted individual the various abilities tapped by tests of intelligence should be identical, or at least close to each other, in quantitative value. Therefore, in the normal individual inter-test variability, or "scatter", should be small.

The Wechsler Bellevue Intelligence Scale (51), with its eleven subtests, has provided an excellent instrument for studying variation in test performance. For the most part the emphasis has been on the study of clinical or maladjusted groups and little information is to be found in the literature on its use with well adjusted individuals, particularly those at university level. While there have been some studies on university groups (8, 34, 44) it is felt that these groups were not too carefully selected and that there is a need for more careful discrimination of high standing and low standing groups. In this study considerable effort was made to select the experimental, or high standing, group.¹

It is believed that a study of a group of academically well adjusted university students would provide valuable information for a students guidance or counselling program. By comparing that information

1. See Chapter III P. 13

with the equivalent information on failing students the counselling service might be able to more easily determine the type of pattern on the Wechsler Bellevue Scale which might help differentiate the potentially successful student from the potentially unsuccessful student. This may be in terms of straight intelligence level or emotional adjustment as revealed by subtest scatter.

The Problem

The purpose of this study is to determine the characteristics of a group of high standing, academically well adjusted, university students as revealed by the scatter indices of the Wechsler-Bellevue Intelligence Scale. It is hypothesized that there will be minimal scatter in the academically well adjusted group. By means of better methods of selection than have been used in other studies of this type (8, 34, 44) it seems reasonable to assume that vocabulary scatter should be small for an academically high standing group, since their capacities presumably have been highly and evenly developed. They will be compared with a control group of failing students who have been referred to the Student Advisory Services at the University of Alberta.

A secondary aspect of the study will be to describe and compare the various subgroups within the experimental group, namely the males to the females; the 17 - 19 year old students to the 20 - 23 year old students; the 75 - 79% average to the 80 - 85% average; the Arts students to the Science students.

Finally, for interest, the results of this study will be compared with the "normal" groups studies by Estes (8), Merrill and Heathers (34), and Rakusin (44).

For the purposes of this study the dynamic aspects will be ignored in favour of an objective emphasis.

Definition of Terms Used

Scatter has been defined by Rabin (42) as "the variability of subtest scores". Rapaport (46) calls it "the pattern or configuration formed by the distribution of weighted subtest scores of an intelligence test". Mayman's (33) definition of scatter is "unevenness in the level of attainment on different tests". In general, these definitions apply to most of the methods used in the various studies of scatter on the Wechsler Bellevue Intelligence Scale.

The principal means of studying scatter on the Wechsler Bellevue, as utilized by Rapaport (46), consists of scatter from the Vocabulary, scatter from the Verbal Mean and Performance Mean for the Verbal and Performance subtests respectively, and scatter from the Modified Verbal Mean and Modified Performance Mean. Vocabulary Scatter is the difference between the weighted vocabulary subtest score and each of the remaining weighted subtest scores. Mean Scatter is the difference between any weighted subtest score and the average of all the weighted subtest scores, with the exception of Digit Span and Arithmetic.¹ Modified Mean Scatter is the difference between any Verbal weighted subtest score and the mean of all the other Verbal weighted subtest scores, excluding Digit Span and Arithmetic, and the difference between any Performance weighted subtest score and the mean of all the other Performance weighted subtest scores.

1. Digit Span and Arithmetic were excluded for both "mean scatter" and "modified mean scatter" on the grounds that "impairments of Digit Span and Arithmetic scores were so general in most of the clinical and control groups that their inclusion would have vitiated the representativeness of the mean as a central tendency of the scores". (46 P. 53).

A different approach to the problem was taken by Whiteman (52), who did a study of group of schizophrenics, using "altitude" as his reference point for scatter analysis. His altitude measure is a rather cumbersome method of obtaining subtest ratios instead of differences, which is purported to keep altitude uncorrelated with the test deviation and thus act as a control on mental age. By this device he found significant differences between his schizophrenics and control group of nurses, concluding "... that within the limits of size and selectivity of our experimental populations, altitude offers promise of becoming a practicable, psychologically meaningful, and experimentally fruitful vantage point for the derivation of scatter patterns". Despite this optimistic outlook, offered in 1950, no further studies by this means are reported in the literature.

Alimena (2), in 1951, outlined a method to achieve comparability of scores on the Wechsler Bellevue subtests, and to thus evaluate their dispersion or scatter. The principal advantage of her method is that it provides a ratio scale for the different ranges of age and IQ. Like Whiteman's (52), no further studies seem to have been done using this approach.

On the basis of Rapaport's (46) contention that "... vocabulary has long known to be a fair representative of the intelligence level and to remain relatively unimpaired by maladjustment", Vocabulary Scatter will be used for the purposes of this investigation. Further, it is a reasonable basis for comparison with other studies, since that standard of study has been used frequently.

Chapter II

SURVEY OF THE LITERATURE

Studies on Clinical Groups

The majority of the investigations of scatter on the Wechsler Bellevue have been concerned with the task of differentiating clinical groups from each other, or from normals. Since this study is concerned only with work which has been done on groups of university students it is intended to give but a cursory glance at some of the more important clinical studies. Comprehensive reviews of the literature have been done by Mayman (33), Rabin (42), Kogan (27) and Rabin and Guertin (43).

As they are probably the largest groups of "functional" disorders encountered in clinical practice the subgroups Schizophrenia and Neurosis have, understandably, received the most attention. Wechsler Bellevue studies of every type on Schizophrenia (9, 10, 17, 19, 22, 26, 27, 31, 32, 35, 36, 37, 40, 41, 46) and Neurosis (16, 21, 22, 27, 29, 35, 40, 46, 50) have failed to produce any consistent clear cut scatter pattern for either of these nosological groups. Scatter has been found to exist in both, but not in a manner which would permit the clinician to use it as a sole, absolute standard for diagnosis. The same is true also for Paretics (16, 31); Manics and Depressives (16, 41, 46, 49); Paranoids (46); Mental Defectives (32); and Psychopaths (40).

Various types of normals or controls have been used in the above studies. They consist of such diverse groups as Wechsler's norms (29, 31, 31)¹; Rapaport's Kansas State Patrolmen (26, 35, 46, 50)²;

1. 51, Table 10, P. 111.

2. "... that of the normal cases was obtained from 54, randomly chosen patrolmen and officers of the Kansas State Highway Patrol" (46, P. 16).

hospital attendants (16); hospital patients (21); student nurses (40); and office employees (50). No attempt will be made to compare any of these "normals" with the experimental group in this study because they have been selected from an entirely different portion of the general population and little attempt has been made to control such variables as age, academic level or cultural background.

It is anticipated that in the comparatively well adjusted experimental group of this study there will be minimal scatter. Therefore, while clear cut scatter patterns have not been discovered in the clinical groups it will be possible to differentiate the experimental group of this study from clinical groups by virtue of extent of scatter, if not by pattern.

Studies on University and College Groups

Of specific interest here is the work done by Estes (8), Merrill and Heathers (34) and Rakusin (44). Estes (8), in 1946, did a study of Wechsler Bellevue scatter on 102 students at Harvard University. One-third of his group were in graduate school or had received graduate degrees. One-fifth of the group were majoring in psychology, while the remainder were fairly evenly distributed over other fields of study. He determined the group's range of scatter from the Vocabulary subtest score. From the results Estes (8) concluded that Rapaport's (46) assumption that a well adjusted person should deviate little on the Wechsler Bellevue subtests, and that if such deviations are found they are to be interpreted as evidence of impairment, needed qualification. Like Wechsler (51), he found that superior adults tended to have a higher Verbal IQ than Performance IQ. The mean subtest deviations from Vocabulary for Estes (8) group are in close agreement with those for

Rapaport's (46) superior normals. Deviations on Picture Arrangement and Object Assembly are considered normal, by Estes (8), for groups of superior and very superior adults. This led him to postulate "... when pattern of deviation subtest scores from Vocabulary are being used as aids in the differential diagnosis of personality disorders, a correction for normal scatter should be made in those cases where the vocabulary level and the occupational history indicate that the pre-maladjustment IQ exceeds 110. Such a correction is most certainly indicated for the deviation scores on the Picture Arrangement and Object Assembly subtests".

A fault of the above study is considered to be the inadequate control of the academic and age level of the subjects. They consisted of fairly advanced students who were not necessarily high standing in the sense of academic achievement. It is believed that the subjects were so generally selected that the results could only be of general interest and perhaps lacked significance.

In 1952 Merrill and Heathers (34) did a comprehensive study on 429 male students who had passed through the counselling center of the University of Washington. The authors considered the group to be "... a fairly normal sample of the University of Washington student population". The Vocabulary scatter for this group was compared with Estes (8) students and Rapaport's controls. The authors found scatter occurred for their group but that no consistent pattern was indicated from the three studies. The groups were similar on Comprehension, Information, Digit Span and Digit Symbol but were different on Picture Arrangement, Picture Completion, Block Design and Object Assembly. Large deviations were found to occur on Arithmetic, Digit Span, and

Picture Arrangement in all three of the studies, being the only consistent "pattern" which might be suggested. Merrill and Heathers conclude "... although correction for "normal" scatter cannot be made in a quantified way, consideration should be given to the evidence that considerable scatter is to be expected". Contrary to Estes (8) data, Merrill and Heathers (34) group did not do better on the Verbal than on the Performance scale.

As in the case of Estes (8), no effort was made to control the academic or age level of the subjects. The selection was too general, was restricted to males, and the contention of adequate adjustment is believed questionable as the subjects had passed through the University of Washington counselling center for some particular reason.

In 1949 Rakusin (44) did a study of scatter scores on the Wechsler Bellevue for a group of adjusted and maladjusted college students. The experimental group consisted of 100 clients who had been administered the Wechsler Bellevue as part of the services of the Psychological Clinic at Pennsylvania State College. Rakusin states "... this group was considered to represent a group of maladjusted college students".

His control group consisted of 80 volunteer non-referral students who had been randomly selected from the general student population of Pennsylvania State College. He says "... the control group was considered to be a representative of adjusted students at Pennsylvania State College".

Comparison was made between the clinic group and control group in regard to all of the scores yielded by the test, as well as

in terms of total scatter, mean scatter, vocabulary scatter, and Verbal Scale IQ minus Performance Scale IQ. He found the clinic group tended to have greater total scatter but the difference ceased to be significant when the effects of age and IQ on total scatter were ruled out by analysis of multiple covariance. Rakusin believed the difference obtained could not be attributed to maladjustment. He found no differences great enough to be used feasibly for clinical diagnostic purposes at the Pennsylvania State College Psychological Clinic.

A secondary aspect of Rakusin's (44) study was to compare the Vocabulary scatter for his control group with that found by Estes (8) for his group of university students. All of the average vocabulary scatter scores for Rakusin's (44) group were found to be significantly higher than for Estes (8) group. The pattern of these average scores showed considerable disparity between the two groups, leading Rakusin (44) to conclude "... this suggests a lack of uniformity in normal scatter patterns on vocabulary scatter". Further, Rakusin's (44) control group did not show a higher Verbal than Performance IQ, as was the case for both Estes (8) and Merrill and Heathers (34) groups.

Once more, Rakusin (44) did not have a carefully selected group, particularly in respect to age and academic level. In Rakusin's (44) work, while the clinical group appears to have been thoughtfully selected, the normal or control group might have been selected with greater care. Further, it appears that, here, we are comparing a clinical group with an apparently well adjusted group in the emotional sense and, perhaps, not in the academic sense. In the present study, it is of interest to note that a failing group of students has been compared with

an academically eminently well adjusted group.

In summary, despite the fact that the above studies (8, 34, 44) have been conducted on Wechsler Bellevue scatter for university students, it is felt that the results have been inconclusive enough to warrant further investigation. Through better selection of subjects, controlling such important variables as academic and age levels, it is expected that this particular study will show less vocabulary scatter than those reported previously. It is to be noted again that the present study ventures forth into the apparently heretofore untested area of the academically high standing individual at university. This area is an important one in both potential and actual achievement. Furthermore, it may be a source of test norm ideals for an upper level academic group as measured by the Wechsler Bellevue Intelligence Scale.

Chapter III

PROCEDURE

This chapter will deal with a description of the measuring device used in this study; the method of its administration and scoring; the selection of the experimental and control groups; and a general discussion of the method of determining the results.

Description of the Test

The test used in this study is the Wechsler Bellevue Intelligence Scale Form 1. This test has been standardized on adults. It consists of a Verbal and Performance section, each of which contains a number of subtests. The Verbal part has Information, Comprehension, Digit Span, Arithmetic and Similarities subtests, with Vocabulary as an alternative. The Performance part has Picture Arrangement, Picture Completion, Object Assembly, Block Design and Digit Symbol subtests. Each subtest yields a raw score, which is converted to a weighted score (by a standard score technique). The weighted scores for the Verbal and Performance sections are then summed, being converted to their respective IQ's by means of tables corrected for age. Thus the test reveals a Verbal IQ and a Performance IQ. The total sum of the weighted scores yields the Full Scale IQ, also by means of tables corrected for age. A complete description of the test, as well as directions for its administration and scoring, are to be found in Wechsler's (51) book, The Measurement of Adult Intelligence.

Test Administration and Scoring

Test administration for the control, or failing, group was

principally done by two staff members of the Student Advisory Services.¹
The period of testing was from December 1953 to February 1955.

All but one of the experimental, or academically high standing, group were tested and scored by the writer.² Test administration was done in November 1954 and averaged about 60 minutes per test. Wechsler's (51) directions and scoring were rigidly followed throughout, except for the necessary modification of the Information subtest for the benefit of Canadian subjects.³

A check of the scoring for the experimental group was done with the assistance of a member of the Department of Psychology at the University of Alberta.⁴ This was concerned mainly with the Verbal subtests of the Wechsler Bellevue, as the Performance subtests have a fixed method of being answered and scored. On the Information subtest controversial items numbers 3, 10, 13 and 20 to 25 were checked. All the items on the Comprehension and Similarities subtests were checked, as well as items 30 to 42 and any partial credits for items 1 to 30 on the Vocabulary subtest. This checking was necessary because of the difficulty in objectively scoring those items outlined above.

-
1. Miss Lolita Wilson, Department of Psychology, University of Alberta.
Miss Rita Hrynyk, a graduate student of the University of Alberta.
 2. Two of the volunteers were available for testing at the same time only, so Miss Rita Hrynyk kindly consented to administer one of the tests. Procedure of administration was fully discussed and is assumed to have been followed for this one case.

3. Wechsler Who is President of the U.S.?
 Who was President before him?
 How tall is the average American woman?
 What is the population of the U.S.?
 When is Washington's birthday?

Modification Who is Prime Minister of Canada?
 Who was Prime Minister before him?
 How tall is the average Canadian woman?
 What is the population of Canada?
 When is Queen Victoria's birthday?

4. Dr. D. Spearman, Department of Psychology, University of Alberta.

Selection of the Experimental Group

In order to control the factors of age and level of academic attainment the subjects chosen for this study were restricted to those students, age 17 to 23, who were then registered in their second year at the University of Alberta. These students were required to have an average of 75% or better for their High School leaving, and first year final results at the University. They were chosen from all the schools and faculties represented at this institution.

Seventy-eight students comprised the initial selection. They were contacted by personal letter (Appendix A) and were asked to volunteer for testing. To facilitate their response, an addressed, stamped card (Appendix B) with a blank space for date and time available for the test, was enclosed with the personal letter. Fifty-nine of this group appeared for testing, with one test having to be terminated because of the subject's reluctance to complete the test.

The refinement of selection was to check the students records at the Registrars Office and to accept only those subjects who maintained a 75% or better average for their High School leaving and first and second year final results at the University. This provided a total of 50 subjects, whose age range was from 17 to 23 years inclusive; whose academic level was second year university; and whose cultural and social economic levels were comparable. The type of course, by sex, being taken at the time by this group is shown in Table I.

Selection of the Control Group

A search was made of the files maintained on those students who

Table I

Students in Experimental Group, by Sex,
Enrolled in the Various University Courses.¹

Science Courses (N = 37)			Arts Courses (N = 13)		
<u>Course</u>	<u>Male</u>	<u>Female</u>	<u>Course</u>	<u>Male</u>	<u>Female</u>
Agriculture	3		Commerce	6	
Chemistry	1	2	English Literature		1
Dentistry	2		History	1	
Engineering	13		Law	1	
Household Economics		2	Modern Languages		1
Laboratory Technician		1	Teaching	1	2
Mathematics	1	2			
Medical Science	2	1			
Nursing		3			
Pharmacy	2				
Physics	2				

1. The grouping for this table was taken from Information for Prospective University Students, prepared by the Student Advisory Services of the University of Alberta (P. 11).

had been referred to the Student Advisory Services at the University of Alberta. All the Wechsler Bellevue record forms were extracted from these.

In consultation with the psychologist of the Student Advisory Services the students records were closely checked and those tests on actual failing students only were finally accepted.¹ This comprised a total of 35 students.

The control, or failing group, consists of thirty-one male and four female students. Their age range is from 18 to 27 years, with a mean of 22 years of age. The type of course, by sex, being taken at the time by this group is shown in Table II.

Method of Determining the Results

Vocabulary scatter was determined for the experimental and the control groups, being subsequently compared by means of the Critical Ratio. This was also done for the subgroups in the experimental group, as well as to compare the latter by Critical Ratio with the normals of Estes (8), Merrill and Heathers (34) and Rakusin (44). The results will be fully discussed in the next chapter.

1. Miss Lolita Wilson, Department of Psychology, University of Alberta who defined failing students as those who do not successfully complete their year at University.

Table II

Students in Control Group, by Sex,
Enrolled in the Various University Courses.¹

Science Courses (N = 18)			Arts Courses (N = 17)		
<u>Course</u>	<u>Male</u>	<u>Female</u>	<u>Course</u>	<u>Male</u>	<u>Female</u>
Chemistry	1		Commerce	3	
Dentistry	1		English	2	2
Engineering	8		History	1	1
Geology	1		Law	5	
Mathematics	1		Philosophy		1
Medical Science	3		Teaching	2	
Pharmacy	1				
Physics	1				
Zoology	1				

-
1. The grouping for this table was taken from Information for Prospective University Students, prepared by the Student Advisory Services of the University of Alberta (P. 11).

Chapter IV

RESULTS

This chapter will consist of three parts. Part one will outline the findings for the experimental and the control groups; what occurred when these two groups were compared; and the bearing this comparison has upon the hypothesis that there will be minimal scatter for the experimental, or academically well adjusted, group of university students.¹

Part two will be a discussion of the findings for the sub-groups of the experimental group. Specifically this will be comparing the males to the females; the 17 - 19 year old to the 20 - 23 year old; the 75 - 79% average to the 80 - 85% average; the Arts students to the Science students.

Part three will be a discussion of other studies done on university students, namely those of Estes (8), Merrill and Heathers (34), and Rakusin (44). The "normals" of these three studies will be compared to the experimental group of this study, where there is sufficient test information to do so.

1. All findings will be subjected to a test of significance by means of the Critical Ratio. The Probability Table (Table VIII) on Page 59 of G. Milton Smith's A Simplified Guide to Statistics for Psychology and Education was used in this study. CR's of 1.96 for significance at the 5% level of confidence and 2.58 for significance at the 1% level of confidence will be used throughout.

Part I

Experimental Group (N = 50)

The experimental group has mean IQ's of 131, 124 and 131 on the Verbal, Performance and Full Scales, respectively. Table III indicates the mean and standard deviation for each of the subtests, as well as the critical ratio for vocabulary scatter. It will be seen that scatter is significant at the 1% level of confidence for Comprehension, Arithmetic, Similarities, Block Design and Object Assembly. It is in a positive direction for all but Object Assembly and Digit Span. Digit Span is significantly different, being almost at the 1% level of confidence.

It is interesting to note that the lowest standard deviation for the Verbal Scale occurs on Information and Vocabulary, reflecting the small spread of scores for these two subtests. Digit Span has the largest standard deviation, or spread of scores. On Information and Vocabulary there should not be a wide variation in the individuals scores as these subtests are influenced by the subjects level of education. The experimental group was specially selected in that respect. It is to be expected that Digit Span would show much variation, as this subtest is not influenced by education. Rapaport (46) contends it is a measure of the individuals degree of attentiveness, therefore reflecting the subjects personal involvement in the test situation. From that he contends that a low score on Digit Span is indicative of a predisposition to anxiety on the part of the subject.

On the Performance Scale the lowest standard deviation occurs on Picture Completion and Block Design, with the largest standard deviation occurring on Picture Arrangement.

Table III

Critical Ratio's from the Vocabulary for the
Experimental Group (N = 50)

Subtest	Mean	SD	CR
Inf	14.10	1.32	1.77
Comp	15.12	1.63	4.93x
Digits	12.52	2.87	2.54x
Arith	15.52	2.43	4.82x
Sim	15.08	1.56	4.97x
Vocab	13.64	1.35	
Verbal Scale IQ	130.78	6.74	
PA	13.20	2.47	1.16
PC	13.20	1.41	1.57
BD	15.30	1.57	5.72x
OA	12.74	1.79	2.81x
Dig Sym	13.46	2.14	1.85
Performance Scale IQ ...	123.64	7.48	
Full Scale IQ	130.66	6.10	

x At the .01 or 1% level of confidence
xx At the .05 or 5% level of confidence

It is obvious that the experimental group scored low on the Vocabulary subtest, with the standard deviation indicating that individually they tended to score at about the same level. This low score, in relation to the other subtests, particularly those in the Verbal Scale, is the principal reason for the appreciable amount of vocabulary scatter for the experimental group. A possible explanation for the low vocabulary level is the fact that of the experimental group only 13 students were in an Arts pattern while 37 students were in a Science pattern. Further, 13 of the 37 Science pattern students were in the faculty of Engineering, where the course requisites include few subjects which might enhance the student's knowledge in respect to the Vocabulary and Information subtests.

The vocabulary scatter for the experimental group tends to refute the hypothesis that a group of academically well adjusted students will show minimal scatter on the Wechsler Bellevue Intelligence Scale.

Control Group (N = 35)

The control group has mean IQ's of 121, 117 and 122 on the Verbal, Performance and Full Scales, respectively. Table IV indicates the mean and standard deviation for each of the subtests, as well as the critical ratio for the Vocabulary scatter. Scatter is significant at the 1% level of confidence for Similarities and at the 5% level of confidence for Comprehension. The remainder of the subtests are well below becoming significant, even at the 5% level of confidence. It can therefore be seen that there is very little scatter from the vocabulary for the control group. This may be due to the better ratio

Table IV

Critical Ratio's from the Vocabulary for the
Control Group (N = 35)

Subtest	Mean	SD	CR
Inf	12.77	1.58	.22
Comp	13.49	2.40	2.00 _{xx}
Digits	11.46	3.14	1.69
Arith	12.71	3.03	.37
Sim	14.40	2.18	4.06 _x
Vocab	12.49	1.71	
Verbal Scale IQ	120.77	2.55	
PA	12.57	3.17	.13
PC	12.00	2.28	1.02
BD	13.20	2.57	1.37
OA	12.66	2.66	.32
Dig Sym	12.86	1.83	.88
Performance Scale IQ ...	117.46	3.80	
Full Scale IQ	121.77	2.67	

x At the .01 or 1% level of confidence
 xx At the .05 or 5% level of confidence

of 18 Science students to 17 Arts students. Also, low scores are not to be expected as such individuals would not have possessed the intelligence to attain university level and high scores are not expected as these people would likely be successful students academically.

The control group has the lowest standard deviation for the Verbal Scale on Information and Vocabulary, with the highest standard deviation for that scale occurring on Digit Span. The Performance Scale shows the lowest standard deviation on Digit Symbol and the highest on Picture Arrangement. This is much the same pattern as was shown by the experimental group, being exactly the same for the Verbal Scale. Once more, the low standard deviation for Information and Vocabulary is considered a result of the subjects educational level, whereas the high standard deviation for Digit Span is likely a measure of personal involvement rather than straight intelligence.

Contrary to the hypothesis that an academically well adjusted group of students would show minimal vocabulary scatter on the Wechsler Bellevue, the control, or failing group, in this study has shown the least amount of scatter. This may be the result of choosing the subjects, as the control group has almost a one to one ratio of Arts to Science students. Also, it may be because of the experimental groups high development and extended specialization.

Experimental and Control Groups Compared

The experimental group has considerably higher Verbal, Performance and Full Scale IQ's than the control group, although the standard deviation for each scale is smaller for the control group. The low standard deviations for the control group arises from the expectation

that very low scoring individuals would not be at university level and very high scoring individuals would not be failing academically. A wide range of scores is to be expected for the experimental group, as some of the subjects would score low on the Wechsler Bellevue but do well academically through extra effort and thus be in the same group as those who score very high on the test.

Table V shows that the mean for each subtest of the experimental group is higher than for the control group. Except for the Digit Symbol subtest the control group has a higher standard deviation for all the other subtests.

The critical ratio for the differences in subtest scores is significant at the 1% level for Information, Comprehension, Arithmetic, Vocabulary, Picture Completion and Block Design, being all positive for the experimental group.

A summation of the mean differences for each subtest from the vocabulary, for the experimental and control group, is indicated in Table VI. The experimental group has a mean of 1.00, while the control group has a mean of but .626, a difference of .374 in favor of the latter.

Table V and VI confirm the fact that there is greater scatter for the experimental, as opposed to the control, group of students. Therefore this study does not support the hypothesis that there will be a minimal amount of scatter on the Wechsler Bellevue for a group of high standing, academically well adjusted, students.

Table V

Critical Ratio's for the Experimental Group (N = 50) and the Control Group (N = 35)

Subtest	EXPERIMENTAL GROUP				CONTROL GROUP				DIFFERENCE	
	Mean	SD	CR from Voc	Mean	SD	CR from Voc	(Exp) - (Con)	CR (Exp) - (Con)		
Inf	14.10	1.32	1.77	12.77	1.58	.22	1.33	4.03x		
Comp	15.12	1.62	4.93x	13.49	2.40	2.00xx	1.63	3.54x		
Digits	12.52	2.87	2.54x	11.46	3.14	1.69	1.06	1.58		
Arith	15.52	2.43	4.82x	12.71	3.03	.37	2.81	4.53x		
Sim	15.08	1.56	4.97x	14.40	2.18	4.06x	.68	1.51		
Voc	13.64	1.35		12.49	1.71		1.15	3.29x		
PA	13.20	2.47	1.59	12.57	3.17	.13	.63	.98		
PC	13.20	1.41	.75	12.00	2.28	1.02	1.20	2.79x		
BD	15.30	1.57	3.47x	13.20	2.57	1.37	2.10	4.29x		
OA	12.74	1.79	.28	12.66	2.66	.32	.08	.015		
Dig Sym	13.46	2.14	3.44x	12.83	1.83	.88	.60	1.39		

x At the .01 or 1% level of confidence
xx At the .05 or 5% level of confidence

Table VI

Total Mean Differences from the Vocabulary for the
Experimental Group (N = 50) and the Control Group (N = 35)

<u>Subtest</u>	<u>Mean Difference (Experimental Group)</u>	<u>Mean Difference (Control Group)</u>
Inf .....	.46	.28
Comp	1.48	1.00
Digits	1.12	1.03
Arith	1.88	.22
Sim	1.44	1.91
PA .....	.44	.08
PC .....	.44	.49
BD	1.66	.71
OA .....	.90	.17
Dig Sym .....	.18	.37
Total	10.00	6.26
Mean	1.00	.626

Part II

Males and Females of the Experimental Group

Table VII reveals considerable scatter from the vocabulary for both males and females of the experimental group. The males show a significant difference at the 1% level of confidence for Comprehension, Arithmetic, Similarities, Block Design and Object Assembly and a significant difference at the 5% level of confidence for Digit Symbol. The pattern is much the same for the females, whose difference is significant at the 1% level of confidence for Comprehension, Arithmetic, Similarities, Block Design and Digit Symbol and approaching the 1% level of confidence for Digit Span.

A comparison of the subtest scores for the males and the females show the males as being slightly higher on all subtests except Similarities and Digit Symbol. The critical ratio for these differences indicates that the two subgroups are practically at the same level on all subtests except Digit Symbol. On the latter the females excel the males, with the difference being significant at the 1% level of confidence. As is to be expected, they have the same IQ level on all Scales except the Performance, where the males score but one point higher than the females.

For the Verbal Scale the males have the lowest standard deviation on Vocabulary and Information, and the highest on Digit Span. This is true also for the females, except their lowest standard deviation occurs in the order of Information, then secondly Vocabulary.

On the Performance Scale the males have the lowest standard deviation on Object Assembly and Picture Completion and highest on Picture Arrangement. The females are lowest on Picture Completion and

Table VII

Critical Ratio's for Males (N = 35) and Females (N = 15) of the Experimental Group

Subtest	MALES			FEMALES			DIFFERENCE	
	Mean	SD	CR from Voc	Mean	SD	CR from Voc	(Males)-(Females)	CR (Males)-(Females)
Inf	14.26	1.37	1.34	13.73	1.04	1.23	.53	1.47
Comp	15.03	1.61	3.43x	15.33	1.65	3.94x	.30	.59
Digits	12.97	2.94	1.59	11.47	2.35	2.51xx	1.50	1.92xx
Arith	15.54	2.58	3.49x	15.47	2.04	4.28x	.07	.10
Sim	15.06	1.63	3.62x	15.13	1.34	4.02x	- .07	.16
Vocab	13.83	1.32		13.20	1.27		.63	1.58
Verbal Scale IQ ..	130							
PA	13.26	2.67	1.14	13.07	1.86	.22	.19	.29
PC	13.40	1.46	1.30	12.73	1.21	1.04	.67	1.67
BD	15.37	1.70	4.28x	15.13	1.24	4.19x	.24	.57
OA	12.83	1.45	3.13x	12.53	2.08	1.06	.40	.60
Dig Sym	12.94	2.20	2.07xx	14.67	1.36	3.06x	-1.73	3.33x
Performance Scale IQ ..	124			123				
Full Scale IQ	130			130				

x At the .01 or 1% level of confidence
xx At the .05 or 5% level of confidence

Block Design. Contrary to the males, the females highest standard deviation for the Performance Scale occurs on Object Assembly.

An explanation for the females higher score on the Digit Symbol subtest is the fact that females generally do better than males on tests of this type.

Age Groups of the Experimental Group

As can be seen from Table VIII, the 17 to 19 year old age group scores relatively the same on all subtests as the 20 to 23 year old age group, although each age group shows a fair amount of vocabulary scatter. The younger age group has a higher Full Scale IQ, as they did appreciably better than the older age group on the Verbal Scale.

The younger age group has a difference from the vocabulary significant at the 1% level of confidence for Comprehension, Arithmetic, Similarities and Block Design, and at the 5% level of confidence for Object Assembly.

The older age group has a difference from the vocabulary significant at the 1% level of confidence for Comprehension, Digit Span, Similarities and Block Design, and at the 5% level of confidence for Arithmetic.

On the Verbal Scale the younger age group has the lowest standard deviation on Information and the highest on Digit Span. The older age group is lowest on Vocabulary and, like the younger, highest on Digit Span.

On the Performance Scale, the standard deviation for both groups is lowest on Block Design, but the younger age group is highest on Digit Symbol, closely followed by Picture Arrangement, while the older age group is highest on Picture Arrangement.

Table VIII

Critical Ratio's for the Two Age Groups, 17 to 19 (N = 30) and 20 to 23 (N = 20) of the Experimental Group

Subtest	17 TO 19 YEAR OLD				20 TO 23 YEAR OLD				DIFFERENCE		
	Mean	SD	CR from Voc	Mean	SD	CR from Voc	(17 - 19)-(20 - 23)	CR	(17 - 19)-(20 - 23)	CR	
Inf	14.10	1.33	1.35	14.10	1.30	1.08	0	0		0	
Comp	15.13	1.83	3.48x	15.10	1.34	3.68x	.03	.066			
Digits	12.93	2.78	1.16	11.90	2.90	2.61xx	1.03	1.26		1.26	
Arith	15.73	2.21	4.35x	15.20	2.71	2.31xx	.53	.73		.73	
Sim	14.90	1.47	3.33x	15.35	1.65	3.72x	- .45	1.00		1.00	
Vocab	13.60	1.54		13.70	1.00		- .10	.28		.28	
Verbal Scale IQ ..	132			129							
PA	13.20	2.04	.43	12.90	2.98	1.14	.50	.66		.66	
PC	13.07	1.52	1.32	13.40	1.16	.88	- .33	.87		.87	
BD	15.17	1.45	4.03x	15.50	.66	3.67x	- .33	.65		.65	
OA	12.60	1.98	2.17xx	12.95	1.43	1.92	- .35	.73		.73	
Dig Sym	13.63	2.06	.064	13.20	2.25	.91	.43	.68		.68	
Performance Scale											
IQ ..	123			124							
Full Scale IQ	132			130							

x At the .01 or 1% level of confidence
xx At the .05 or 5% level of confidence

It is understandable that these subgroups of the experimental group should be alike, as there is not much of an age spread. Also, the 17 to 19 year olds have a proportion of ten females to twenty males, while the 20 to 23 year olds have a proportion of five females to ten males.

Final Average Groups of the Experimental Group

Table IX shows that, except for Digit Span, the 80 to 85% group is practically at the same level on all subtests as the 75 to 79% group. The higher average group is significantly different than the lower average group at the 5% level of confidence for Digit Span. Both groups are at almost the same level for Full Scale IQ, but the higher average group showed an appreciably better score on the Verbal Scale IQ.

Both groups have a fair amount of vocabulary scatter. The higher average group shows a significant difference at the 1% level of confidence for Comprehension, Arithmetic, Block Design and Object Assembly, and at the 5% level of confidence for Similarities.

The lower average group shows a significant difference at the 1% level of confidence on Comprehension, Digit Span, Arithmetic, Similarities and Block Design.

On the Verbal Scale the higher average group had the lowest standard deviation on Information and Vocabulary, and the highest on Digit Span. For the same scale the lower average group had the lowest standard deviation on Vocabulary and Information, Their highest was also on Digit Span.

No explanation can be offered for the difference on the Digit Span subtest, in favor of the high average group, other than the usual interpretation that the lower average group were possibly more anxious (46).

Table IX

Critical Ratio's for the Two "Final Average" Groups 80 to 85% (N = 23) and 75 to 79% (N = 27) of the Experimental Group

Subtest	80 TO 85%			75 TO 79%			DIFFERENCE	
	Mean	SD	CR from Voc	Mean	SD	CR from Voc	(80-85%)-(75-79%)	CR (80-85%)-(75-79%)
Inf	14.30	1.21	.92	13.93	1.37	1.51	.37	1.00
Comp	15.30	1.47	3.27x	14.96	1.80	3.70x	.34	.74
Digits	13.52	2.87	.67	11.67	2.57	3.09x	1.85	2.37xx
Arith	15.83	2.44	3.34x	15.26	2.36	3.63x	.57	.84
Sim	14.91	1.47	2.32xx	15.22	1.66	4.51x	- .31	.70
Vocab	13.96	1.30		13.37	1.31		.59	1.59
Verbal Scale IQ ..	131			127				
PA	12.87	2.62	1.79	13.48	2.31	.22	- .61	.87
PC	13.39	1.22	1.54	13.04	1.53	.85	.35	.90
BD	15.30	1.82	2.91x	15.30	1.31	5.36x	0	0
OA	12.39	2.31	2.85x	13.04	1.07	1.00	- .65	1.25
Dig Sym	13.26	2.39	1.23	13.61	2.03	.51	- .35	.56
Performance Scale								
IQ ..	122			124				
Full Scale IQ	130			129				

x At the .01 or 1% level of confidence
 xx At the .05 or 5% level of confidence

On the Performance Scale the higher average group had the lowest standard deviation on Picture Completion and the highest on Picture Arrangement. The lower average group had their lowest standard deviation on Object Assembly and their highest, once again, on the same subtest as the higher average group.

Arts and Science Groups of the Experimental Group

Table X shows that, except for Object Assembly and Digit Symbol, the Arts students excelled the Science students on all of the other subtests, being significantly better at the 5% level of confidence on Information and Digit Span. The next largest difference is on the Vocabulary subtest, but it is not at a significant level. They have equivalent Performance Scale IQs but for the Full Scale IQ, the Arts students did better than the Science students, because of a higher score on the Verbal Scale IQ.

Like the other subgroups of the experimental group the Science students have a fair amount of scatter from the vocabulary. It is significant at the 1% level of confidence for Comprehension, Digit Span, Similarities and Block Design, and at the 5% level of confidence for Arithmetic. Object Assembly also approaches the 5% level of confidence.

Unlike any of the other subgroups of the experimental group, the Arts students have no significant amount of scatter from the vocabulary, except for Object Assembly. On this subtest the difference is significant at the 5% level of confidence. This finding is considered important, as the Arts students displayed the pattern which was expected for the experimental group as a whole and which would have confirmed the hypothesis that minimal vocabulary scatter should occur for high standing

Critical Ratio's for the Arts (N = 13) and Science (N = 37) Groups of the Experimental Group

Subtest	ARTS		SCIENCE		DIFFERENCE	
	Mean	SD	CR from Voc	Mean	SD	CR from Voc
Inf	14.62	.94	.84	13.92	1.35	1.53
Comp	15.23	1.54	1.64	15.08	1.68	4.91x
Digits	14.00	2.66	.16	12.00	2.75	2.98x
Arith	15.54	2.43	1.64	15.51	2.45	2.33xx
Sim	15.23	1.06	1.89	15.03	1.67	4.76x
Vocab	14.15	1.69		13.46	1.17	.69
Verbal Scale IQ ..	132			129		
PA	13.38	2.84	.81	13.14	2.31	.74
PC	13.38	1.43	1.20	13.14	1.37	1.07
BD	15.46	1.75	1.87	15.24	1.53	5.56x
OA	12.69	1.45	2.28xx	12.76	1.87	1.94xx
Dig Sym	13.31	2.77	.89	13.51	1.88	.014
Performance Scale IQ ..	124			124		
Full Scale IQ	131			129		

x At the .01 or 1% level of confidence
 xxx At the .05 or 5% level of confidence

university students. These students scored at about the same level in each of the areas tested by the Wechsler Bellevue and can therefore be rated as functionally well adjusted in that sense.

On the Verbal Scale the Arts students have the lowest standard deviation on Information and Similarities and the highest on Digit Span. The Science students also have the highest standard deviation for this scale on Digit Span but their lowest is on Vocabulary, followed by Information.

For the Performance Scale the Arts students standard deviation is lowest on Picture Completion, followed closely by Object Assembly, and highest on Picture Arrangement. On this scale the Science students also have the lowest standard deviation on Picture Completion and the highest on Picture Arrangement.

The subtest differences on Information and Vocabulary in favor of the Arts students may be the result of the type of courses which the Science students receive at this university, as well as the students previous academic achievements, and interests. The difference on Digit Span suggests the Science students were more "anxious", at least in respect to this test situation. (46)

As noted before, there are almost three times as many Science students as there are Arts students in the experimental group, with thirteen of the Science students being in the faculty of Engineering. The latter faculty offers few courses in their degree pattern which might improve the students knowledge in the area of the two subtests, Information and Vocabulary. Much the same is true also for the other Science patterns, pertinent to the experimental group, namely Agriculture,

Honours Chemistry, Dentistry, Household Economics, Laboratory Technician, Honours Mathematics, Medical Science, Nursing, Pharmacy and Honours Physics.¹

The vocabulary scatter revealed in Table X for the Arts and Science students tends to confirm the suspicion that the appreciable scatter found in the experimental group is attributable to the selection of the subjects. It was unfortunate that the high standing students did not have a more reasonable proportion of Arts students to Science students.

An analysis of the pattern for the Arts and Science students of the control, or failing, group is shown in Table XI. These subgroups are almost equal in size.

For the control group the Science students excel the Arts students on all the subtests except Information, Similarities and Block Design. They are significantly higher than the Arts students, at the 1% level of confidence, on the Block Design subtest and significantly lower than the Arts students, at the 5% level of confidence on the Similarities subtest.

Neither the Arts nor the Science students of the control group show much scatter from the vocabulary, with the Science students showing but slightly more than the Arts students. The Arts students show a significant difference at the 1% level of confidence for Similarities, and at the 5% level of confidence for Digit Span. The Science students show a significant difference at the 1% level of confidence for Block Design, and at the 5% level for Comprehension and approaching that for Similarities.

1. See course requirements contained in the University of Alberta Calendar for 1954 - 55.

Table XI

Critical Ratio's for the Arts (N = 17) and Science (N = 18) Groups of the Control Group

Subtest	ARTS		SCIENCE		DIFFERENCE	
	Mean	SD	CR from Voc	Mean	SD	CR from Voc
CR (Arts)-(Science)						
Inf	12.88	1.86	.62	12.66	1.32	.36
Comp	13.18	2.75	.86	13.78	2.00	2.20xx
Digits	10.53	3.13	2.10xx	12.33	2.92	.19
Arith	12.35	2.23	.10	13.06	2.76	.77
Sim	15.12	1.82	3.96x	13.72	2.27	1.94xx
Vocab	12.47	2.04		12.50	1.42	
Verbal Scale IQ ..	121			121		
PA	11.71	3.53	.77	13.39	2.49	1.33
PC	11.88	2.48	.75	12.11	2.09	.66
BD	11.94	3.00	.62	14.38	1.31	4.18x
OA	12.12	3.27	.38	13.16	1.85	1.22
Dig Sym	13.18	1.66	1.11	12.56	1.92	.01
Performance Scale						
IQ ..	114			119		
Full Scale IQ	119			123		

x At the .01 or 1% level of confidence
xx At the .05 or 5% level of confidence

It is to be noted that the standard deviation for the Arts and Science students of the control group is quite high on practically all of the subtests. The Arts students have the lowest standard deviation for the Verbal Scale on Similarities and Information, with the highest on Arithmetic. The Science students have the lowest standard deviation for the Verbal Scale on Information and Vocabulary, with the highest on Digit Span. For the Performance Scale both subgroups have the highest standard deviation on Picture Arrangement, with the Arts students being lowest on Digit Symbol and the Science students lowest on Block Design.

The Arts and Science students of the control group are not directly comparable to their counterpart in the experimental group. They were not as carefully selected, particularly in respect to age range and academic achievement. Also, the experimental group has a proportion of 15 female to 35 male students, whereas the control group has but 4 female to 31 male students. All the female students of the control group were in an Arts pattern, whereas the female students of the experimental group were predominantly in a Science pattern, in the ratio of 11 Science to 4 Arts. Finally, since there was very little scatter for the control group as a whole, it is expected that the subgroups would show the same trend.

Despite the limitations outlined above it was considered of some value to compare the Arts and Science students of the control group to those of the experimental group.

Part III

Other Studies

Some limitations were encountered in attempting to compare the data for the experimental group of this study with that of the only other studies of this nature to be found in the literature, namely those of Estes (8), Merrill and Heathers (34) and Rakusin (44). In particular, there are no subtest scores available for Estes study. Therefore, this section will be confined to discussing the total IQ's for these four studies; a comparison of subtest scores by means of the critical ratio for the experimental group, Merrill and Heathers' normals, and Rakusin's normals; a discussion of the deviations from the vocabulary for each of the four different studies; and, finally, a graphical representation of the vocabulary scatter for the four studies.

Estes' group had mean IQ's of 128, 119 and 127, on the Verbal, Performance and Full Scales respectively; Merrill and Heathers had 119, 119 and 121 respectively; Rakusin had 122, 124 and 125 respectively; and the experimental group had 131, 124 and 131 respectively. The special selection of the experimental group likely accounts for the generally better scores which it exhibits.

Table XII indicates the subtest scores for the groups, exclusive of Estes study. It can be seen that the experimental group was higher than Rakusin's normals on all the subtests except Object Assembly and Digit Symbol. The experimental group was higher than Merrill and Heathers' normals on all of the subtests.

The standard deviation for the Verbal Scale was lowest on Information, then Vocabulary, for both Rakusin and Merrill and Heathers,

Table XII

Means and Standard Deviations of Wechsler Bellevue Subtest Scores for Rakusin (N = 80),
Merrill and Heathers (N = 429) and Experimental Group (N = 50).¹

Subtest	RAKUSIN		MERRILL AND HEATHERS		EXPERIMENTAL	
	Mean	SD	Mean	SD	Mean	SD
Inf	13.3	1.55	13.03	1.54	14.10	1.32
Comp	13.6	1.86	12.56	1.88	15.12	1.63
Digits	10.8	2.60	10.37	3.03	12.52	2.87
Sim	14.1	1.97	13.53	2.18	15.08	1.56
Vocab	12.6	1.47	12.32	1.59	13.64	1.35
Verbal Scale IQ	122	7.14	119		131	6.74
PA	12.7	2.75	12.34	2.69	13.20	2.47
PC	13.5	1.53	12.96	1.66	13.20	1.41
BD	14.6	1.62	13.91	2.15	15.30	1.57
OA	12.9	2.05	12.62	2.27	12.74	1.79
Dig Sym	14.1	1.87	11.98	2.01	13.46	2.14
Performance Scale IQ	124	7.40	119		124	7.48
Full Scale IQ	125	5.82	121		131	6.10

1. Estes study does not give the subtest scores.

being the reverse of that order for the experimental group. On this same scale all three studies had the largest standard deviation on Digit Symbol.

For the Performance Scale all three studies had the highest standard deviation on Picture Arrangement and the lowest standard deviation on Picture Completion.

Table XIII reveals the significant differences between the subtests for the experimental group and Merrill and Heathers' normals. It is at the 1% level of confidence for Information, Comprehension, Digit Span, Similarities, Vocabulary, Block Design and Digit Symbol, and at the 5% level of confidence for Arithmetic. These differences, all in favor of the experimental group are likely because of better selection of the subjects.

Vocabulary scatter is evident for both of these studies but is more extensive for the experimental group. Scatter is significant at the 1% level of confidence, in respect to Merrill and Heathers' normals, for Digit Span, Similarities and Block Design, and at the 5% level of confidence for Information. The experimental group has scatter at the 1% level of confidence for Comprehension, Arithmetic, Similarities, Block Design and Object Assembly, and approaching the 1% level of confidence for Digit Span. The greater scatter evidenced by the experimental group is believed to be the fault of a disproportionate representation of Arts students to Science students.

Table XIV outlines the relationship of the experimental group to Rakusin's normals, showing the experimental group to be significantly better at the 1% level of confidence for Information, Comprehension, Digit Span, Arithmetic, Similarities and Vocabulary, and at the 5%

Table XIII

Critical Ratio's for Merrill and Heathers Normals (N = 429) and the Experimental Group (N = 50)

Subtest	MERRILL AND HEATHERS				EXPERIMENTAL GROUP				DIFFERENCE	
	Mean	SD	CR from Voc	Mean	SD	CR from Voc	(M and H) - (Exp)	CR	(M and H) - (Exp)	
Inf	13.03	1.54	2.08xx	14.10	1.32	1.77	1.07	3.57x		
Comp	12.56	1.88	.66	15.12	1.62	4.93x	2.56	6.92x		
Digits	10.37	3.03	3.75x	12.52	2.87	2.54x	2.15	3.52x		
Arith	13.17	3.17	1.57	15.52	2.43	4.82x	1.35	2.29xx		
Sim	13.53	2.18	2.95x	15.08	1.56	4.97x	1.55	3.88x		
Vocab	12.32	1.59		13.64	1.35		1.32	4.25x		
PA	12.34	2.69	.039	13.20	2.47	1.16	.86	1.59		
PC	12.96	1.66	1.78	13.20	1.41	1.57	.24	.75		
BD	13.91	2.15	3.88x	15.30	1.57	5.72x	1.39	3.47x		
OA	12.62	2.27	.71	12.74	1.79	2.81x	.12	.28		
Dig Sym	11.98	2.01	.87	13.46	2.14	1.85	1.48	3.44x		

x At the .01 or 1% level of confidence
xx At the .05 or 5% level of confidence

Table XIV

Critical Ratio's for Rakusin's Normals (N = 80) and the Experimental Group (N = 50)

Subtest	RAKUSINS NORMALS			EXPERIMENTAL GROUP			DIFFERENCE	
	Mean	SD	CR from Voc	Mean	SD	CR from Voc	(Rakusin)-(Exp)	CR (Rakusin)-(Exp)
Inf	13.3	1.55	2.92x	14.10	1.32	1.77	.80	3.20x
Comp	13.6	1.86	3.85x	15.12	1.63	4.93x	1.52	4.90x
Digits	10.8	2.60	5.45x	12.52	2.87	2.54xx	1.72	3.44x
Arith	13.2	2.14	1.54	15.52	2.43	4.82x	2.32	4.73x
Sim	14.1	1.97	5.36x	15.08	1.56	4.97x	.98	3.16x
Vocab	12.6	1.47		13.64	1.35		1.04	4.16x
PA	12.7	2.75	.29	13.20	2.47	1.16	.50	1.06
PC	13.5	1.53	3.46x	13.20	1.41	1.57	- .30	1.15
BD	14.6	1.62	8.33x	15.30	1.57	5.72x	.70	2.50xx
OA	12.9	2.05	1.07	12.74	1.79	2.81x	- .16	.47
Dig Sym	14.1	1.87	5.77x	13.46	2.14	1.85	- .64	1.73

x Significant at the .01 or 1% level of confidence
 xx Significant at the .05 or 5% level of confidence

level of confidence for Block Design.

Unlike Merrill and Heathers' normals, but like the experimental group, Rakusin's normals show a fair amount of vocabulary scatter. It is significant at the 1% level of confidence for Information, Comprehension, Digit Span, Similarities, Picture Completion and Block Design. Better methods of selecting the subjects for Rakusin's study would likely have lowered the vocabulary scatter, which is true also for the experimental group.

A better appreciation of the amount of vocabulary scatter can be seen in Table XV. Merrill and Heathers show the least amount, followed by Estes, then the experimental group and, finally, Rakusin. But the range of scatter, which was not available for Rakusin's normals, is least for the experimental group and greatest for Merrill and Heathers' normals.

Table XVI shows the percentage variation of three or more points above or below the vocabulary level for Estes' normals, Merrill and Heathers' normals, and the experimental group. The average percent of deviation of three or more points below the vocabulary level was least for the experimental group, closely followed by Merrill and Heathers' normals, with Estes' normals showing the largest percent of deviation for this measure.

For deviations of three or more points above the vocabulary level Estes normals had the lowest percentage, with Merrill and Heathers normals and the experimental group having about the same percentage figure.

Finally, the average percentage for deviation of three or more points above and below the vocabulary level is practically the same for

Table XV

Deviations of Wechsler Bellevue Subtest Scores from Vocabulary Level for Estes (N = 102), Rakusin (N = 80), Merrill and Heathers (N = 429) and the Experimental Group.

Subtest	MEAN DEVIATION			Experimental Group	RANGE OF DEVIATION		
	Estes	Rakusin	Merrill and Heathers		Estes	Merrill and Heathers	Experimental Group
Inf	0.4	.65	.71	.46	-4 to 5	-3 to 5	-3 to 4
Comp	0.0	1.05	.24	1.48	-6 to 5	-6 to 6	-3 to 6
Digits	-1.0	-1.64	-1.97	-1.12	-9 to 5	-9 to 5	-8 to 4
Arith	-0.7	.437	.84	1.88	-6 to 4	-7 to 8	-4 to 7
Sim	0.7	1.51	1.22	1.44	-4 to 5	-5 to 7	-2 to 5
PA	-2.0	.05	.01	.44	-8 to 3	-8 to 8	-8 to 5
PC	-1.4	.862	.64	.44	-7 to 4	-5 to 7	-3 to 4
BD	0.0	1.96	1.59	1.66	-8 to 5	-6 to 11	-2 to 8
OA	-2.0	2.75	.29	- .90	-8 to 3	-8 to 6	-6 to 3
Dig Sym	-1.0	1.52	- .33	- .18	-7 to 4	-7 to 7	-7 to 6
Total	9.2	12.43	7.84	10.00			

Table XVI

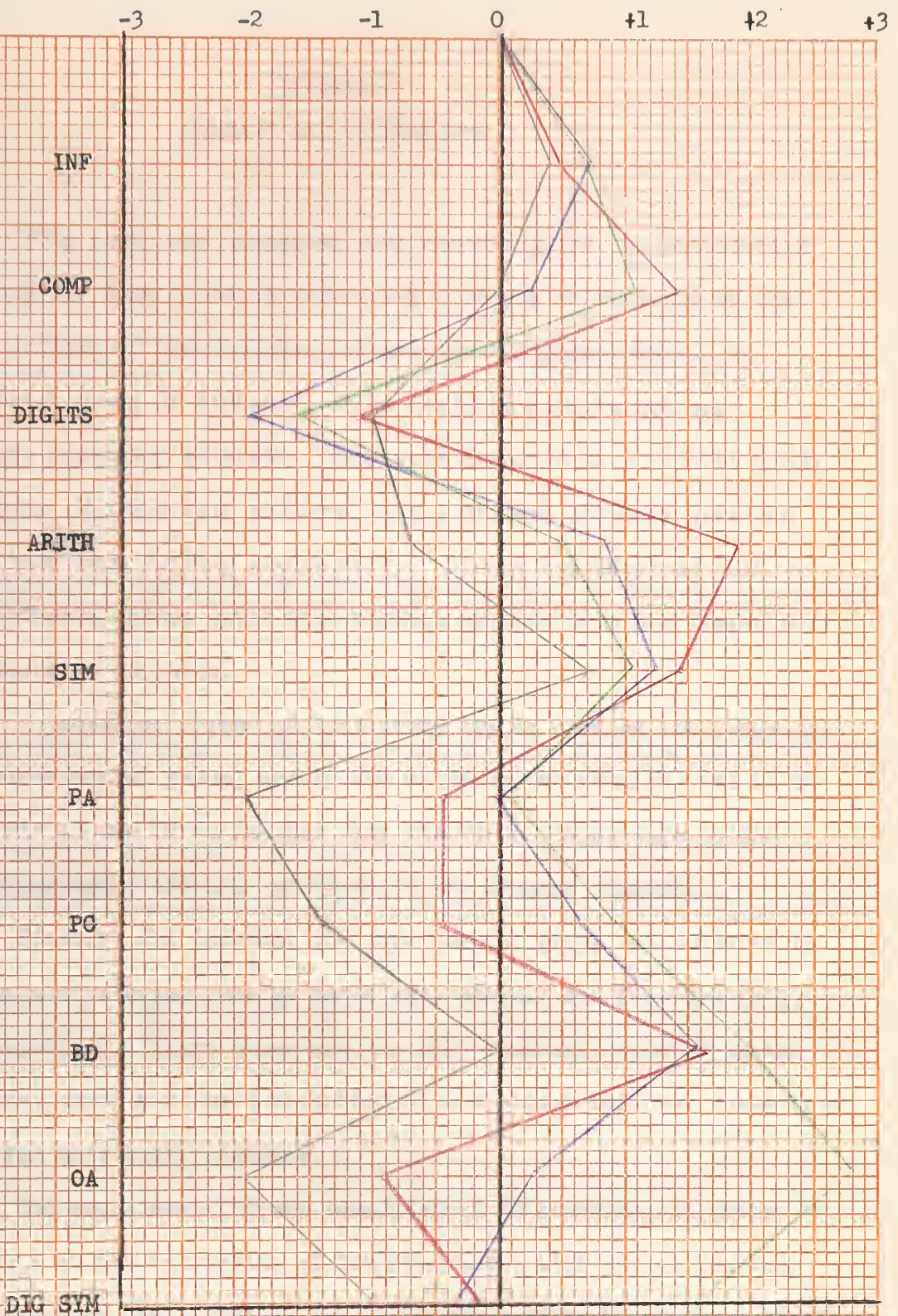
Percentages of Those in Estes (N = 102), Merrill and Heathers (N = 429), and Experimental Group Who Varied 3 or More Points from Vocabulary Level on the Wechsler Bellevue Subtests.

Subtest	DEVIATIONS OF											
	-3 OR MORE				+3 OR MORE				+3 OR MORE			
	Estes	Merrill and Heathers	Experimental Group	Estes	Merrill and Heathers	Experimental Group	Estes	Merrill and Heathers	Experimental Group	Estes	Merrill and Heathers	Experimental Group
Inf	4.9	2.3	2.0	2.0	11.6	2.0	6.9	14.0	4.0			
Comp	15.7	7.0	2.0	11.8	13.7	34.0	27.4	20.7	36.0			
Arith	34.3	44.0	44.0	14.7	8.6	14.0	49.0	52.6	58.0			
Digits	28.4	15.1	10.0	17.6	31.2	48.0	46.1	46.3	58.0			
Sim	2.9	3.3	0	9.8	25.6	26.0	12.7	28.8	26.0			
PA	44.1	20.2	16.0	1.0	19.5	8.0	45.1	39.8	24.0			
PC	26.5	7.0	14.0	2.9	14.9	2.0	29.4	21.9	16.0			
BD	15.7	5.4	0	13.7	37.2	34.0	29.4	42.6	34.0			
OA	36.3	11.4	18.0	1.0	17.7	4.0	37.2	29.1	22.0			
Dig Sym	30.4	19.5	20.0	6.9	14.4	20.0	37.2	34.0	40.0			
Average %	23.9	13.5	12.6	8.1	19.4	19.2	32.0	33.0	32.0			

all three studies. On the Verbal Scale all three studies have the smallest deviation on Information and the largest deviation on Arithmetic and Digit Span. For the Performance Scale all three studies have the smallest percentage of deviation on Picture Completion, with the largest deviation occurring on Digit Symbol for the Experimental group, Block Design for Merrill and Heathers normals, and Picture Arrangement for Estes normals.

Figure I is a graphical representation of the information contained in Table XIV. It shows the mean deviations of the subtest scores from the vocabulary level for the normals of Estes, Merrill and Heathers and Rakusin, and the experimental group of this study. All four studies have practically the same amount of deviation on Information, followed by Digit Span, Similarities and Comprehension, in that order. They show the greatest divergence of deviation on Object Assembly and Digit Symbol.

As in the case of the experimental and control groups of this study the data of Estes, Merrill and Heathers, and Rakusin were not exactly comparable because of the different methods of selecting the subjects, as well as the differences in age levels, academic achievement, sex ratio, and course content. They have been compared to the experimental group solely because they were the only studies reported in the literature, done by means of the Wechsler Bellevue Intelligence Scale, on university students. The results of these studies were considered to be of interest, and are supplementary to this particular investigation.



Mean Deviations of Subtest Scores from Vocabulary Level for
Estes, Merrill and Heathers, Rakusin and the Experimental Group

Estes

Rakusin

Merrill and Heathers

Experimental Group



The graph illustrates the relationship between the two variables over time. The blue series shows a rapid decline from 100 to 0, while the green series shows a peak at time 4 before declining to 0.

Time

Value

Legend: Blue Series

Legend: Green Series

Chapter V

SUMMARY AND CONCLUSIONS

This study was concerned with determining the characteristics of a group of high standing university students as revealed by the scatter indices of the Wechsler Bellevue Intelligence Scale. An experimental group of students, whose academic achievement was high, were specially selected. They were compared to a control group of students, who had been referred to the Student Advisory Services because they were failing academically. It was hypothesized that the experimental group would show minimal scatter from the vocabulary on the Wechsler Bellevue.

A secondary aspect of this study was to compare the subgroups of the experimental group, namely the males to the females; the 17 to 19 year old to the 20 to 23 year old; the 75 to 79% average to the 80 to 85% average; the Arts students to the Science students.

Finally, for interest the experimental group was compared to the normals of studies done by Estes (8), Merrill and Heathers (34), and Rakusin (44). These three are the only studies, reported in the literature, which have been concerned with Wechsler Bellevue vocabulary scatter for university students.

The experimental group consisted of 50 students, in their second year at the University of Alberta, whose high school leaving average had been 75% or better and who maintained that average in their final examinations for both first and second year university. They ranged in age from 17 to 23 years; 35 were males and 15 females; 27 of them had an average of 75 to 79% and 23 an average of 80 to 85%:

37 were Science students and 13 Arts students. They were all given the full Wechsler Bellevue test during the month of November, 1954.

The control group consisted of 35 students who had been referred to the Student Advisory Services at the University of Alberta during the period December 1953 to February 1955 because they were failing academically. They were in first to fourth year attendance at university; ranged in age from 17 to 27 years; 31 were males and 4 females; 18 were Science students and 17 Arts students. Scholastic averages, as determined for the experimental group, could not be adequately evaluated for this group because many of them had repeated years, changed courses, or had done previous work at other universities.

On comparing the experimental group with the control group, by means of the critical ratio, it was found that the experimental group had significantly more vocabulary scatter than the control group. The experimental group had vocabulary scatter significant at the 1% level of confidence for Comprehension, Arithmetic, Similarities, Block Design and Object Assembly, with Digit Span approaching that same degree of significance. The control group had a significant amount of scatter from the vocabulary on only two subtests, being at the 1% level of confidence for Similarities and at the 5% level of confidence for Comprehension. Therefore the hypothesis that a group of high standing, academically well adjusted, students would show minimal scatter from the vocabulary was not supported by this study.

The appreciable amount of vocabulary scatter revealed by the experimental group is believed to be a result of the selection of the subjects. A disproportionate number of Arts students to Science students, in favor of the latter, occurred in the selection of those

students who were maintaining a high standing in their academic work.

The subgroups of the experimental group did not differ a great deal from one another. The females excelled the males, at the 1% level of confidence, on Digit Symbol, with the males doing better than the females at almost the 5% level of confidence, on Digit Span. There was no significant difference between the two age groups. The 80 to 85% average group scored significantly higher than the 75 to 79% average group, at the 5% level of confidence, on Digit Span. The Arts students did better than the Science students, at the 5% level of confidence, on Information and Digit Span.

Of these subgroups the Arts students had by far the least amount of vocabulary scatter, being significant, at the 5% level of confidence, on only the Object Assembly subtest. All of the remaining subgroups showed significant vocabulary scatter for Comprehension, Arithmetic, Similarities and Block Design, with Digit Span and Object Assembly also being significant for the majority of them. This finding supports the belief that the ratio of Arts students to Science students in the Experimental group is the principal reason for the vocabulary scatter which the study revealed.

On comparing the experimental group to studies done on university students by Estes (8), Merrill and Heathers (34) and Rakusin (44), it was revealed that all showed an appreciable amount of vocabulary scatter for the Wechsler Bellevue. It was found that the experimental group had the second largest total mean deviation from the vocabulary level, but that the range of deviation was smallest for the experimental group. The four studies had like vocabulary scatter for Information, Digit Span, Similarities and Comprehension, in that order. They were

most unlike for Object Assembly and Digit Symbol.

All four of the studies reported here show that large deviations, from the Vocabulary at least, are common on Arithmetic, Digit Span, Picture Arrangement and Object Assembly.

Merrill and Heathers' (34) conclusion that "... the use of patterns of deviations of subtest scores from vocabulary level as aids in differential diagnosis with above average and superior adults is a questionable procedure", is borne out only to some extent by the findings of this study. The experimental group showed extensive, rather than minimal, vocabulary scatter. While minimal scatter did not occur for the experimental group, a pattern of scatter does appear to have emerged. This group had very high scores on Comprehension, Arithmetic, Similarities and Block Design.¹ They tended to not do well on Digit Span and Object Assembly.

The pattern displayed by the experimental group may be gainfully applied, in the assessment of problem students, by the Student Advisory Services. A student who scores 120 points or better on the Full Scale, whose Verbal Scale is better than his Performance Scale, and whose pattern of scores is like that of the experimental group of this study should encounter little difficulty, intellectually, in his university work. Should a failing student display that pattern on the Wechsler Bellevue his lack of success can be attributed to causes other than limited intelligence and, possibly, an inability to organize.

1. It may be that this intellectual "quadrad" is characteristic of high level academic achievement in the initial stages of a university career.

In that event the proper therapy for his difficulty may be applied, thus salvaging an individual who has the mental capacity and organization to assimilate the knowledge required at university level.

An interesting result of this study is the difference displayed by the Arts and Science students of the experimental group. The Science students did not do well on the Vocabulary and Information subtests. This suggests it may be a fault of the course content of their university studies, which tends to neglect the areas of endeavour that might improve the scores on those two subtests. Also, a poor grounding in that work, as well as disinterest, could be the reason for many of them choosing a Science pattern rather than an Arts pattern at university level.

Chapter VI

RECOMMENDATIONS

The selection of the subjects for the experimental group probably had a strong bearing upon the negative results in respect to the hypothesis of this study. Another like study should be done, selecting the academic high standing group with the same care but ensuring that there is a proportionate representation of Arts students to Science students.

A better control, or failing group, might also be selected by attempting to choose test protocols on only those students who cannot complete university studies.

Different measures of scatter might also be applied, such as scatter from the total mean or from the Verbal mean and Performance mean for the Verbal and Performance subtests respectively, as well as scatter from the Vocabulary.

By refining the technique of choosing the upper and lower academic groups a better appreciation of scatter would be obtained. Further, the pattern which would result might provide a better yardstick for the Student Advisory Services. In particular they would be better able to predict an individual's possibility of being able to successfully complete a course of study at university level, at least on the basis of intellectual capacity and organizational ability.

Since this study was objective in its approach, another study using the test protocols of the experimental group might be done of the dynamic implications of the responses. An item and content analysis

could materially assist a clinician in his evaluation of responses on the Wechsler Bellevue. During testing an attempt was made by the examiner to fully record the subjects answers to the verbal questions, as well as to note any peculiarities, mannerisms, or aberrant behaviour during the test situation. This would facilitate a dynamic study of a group of high standing, academically well adjusted students.¹

1. All test material and data in respect to the experimental group of this study will be available in the Psychology Department of the University of Alberta.

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APPENDIX A

OBERSE

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 University of Alberta,
 EDMONTON, Alberta.

REVERSE

PLEASE RETURN IMMEDIATELY

I am willing to participate in the study, and will be available (please check days and indicate hours):

Mon. at

Tues. at

Wed. at

Thurs. at

Fri. at

Sat. at

Name

Address

..... Phone

STUDENT ADVISORY SERVICES

UNIVERSITY OF ALBERTA

In an effort to assist this department in its work with students who are having scholastic difficulties we propose doing a study of students whose academic results are in the upper third of the university group. It is believed that the findings of such a study would be of material assistance in determining the specific areas in which these people are in need of help.

The proposed study will consist of the application of a standard intelligence test to each member of the upper group. This test would be of approximately one hour duration, conducted by Mr. W. J. Lott, a post-graduate student in the Department of Psychology.

Since your final results for the last term (1952-53) places you within the upper third of the students of that year, it would be appreciated if you could give us one hour of your time in order to facilitate the outlined investigation. Every assurance is given that complete anonymity of individual test results will be maintained, as only group data of a statistical nature will be used in the final report.

For your convenience a card is enclosed with this letter. It will permit you to signify your willingness to participate in the proposed study and to indicate the particular days and times when you would be available for testing. On receipt of the card Mr. Lott will contact you in regards to specific date, time and place of test. Please indicate, on the card, any change of address or phone number.

Thank you in anticipation of your co-operation in this important study.

Yours sincerely,

AJC/sg

A. J. COOK,
Director

B29770